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Educational Background

March 2005 **Doctor of Engineering in Applied Chemistry**, Waseda University

Thesis title: "A Study on the Electrochemical Fabrication Processes for Three-dimensional Microstructures and Their Application to Functional Devices"

March 2002 **Master of Engineering in Applied Chemistry**, Waseda University

March 2000 **Bachelor of Engineering in Applied Chemistry**, Waseda University

Professional Experiences

January 2007 - Present

Postdoctoral Research Fellow

Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, USA.

April 2004 - January 2007

Research Associate

Department of Applied Chemistry, Waseda University, Tokyo, Japan

Journal Papers

- 1) H. Sato, T. Yamaguchi, T. Isobe, T. Homma, S. Shoji, "Self-aligned formation of nano-holes to arrayed micro glass tubes", *Electrochimica Acta*, in press.
- 2) H. Sato, "Micro/nano fabrication processes based on electrochemical methods", *J. Nano Sci. Tech.*, **5**, 65-68 (2007).
- 3) H. Sato, T. Homma, "Fabrication of magnetic nanodot arrays for patterned magnetic recording media", *J. Nanosci. Nanotech.*, **7**, 225-231 (2007).
- 4) H. Sato, T. Homma, "Fabrication of high-aspect-ratio arrayed structures using Si electrochemical etching", *Sci. Tech. of Adv. Mater.*, **7**, 468-474 (2006).
- 5) H. Sato, T. Homma, K. Mori, T. Osaka, S. Shoji, "Picoliter volume glass tube array fabricated by Si electrochemical etching process", *Electrochim. Acta*, **51**, 844-848 (2005).
- 6) H. Sato, T. Homma, H. Kudo, T. Izumi, T. Osaka, S. Shoji, "Three-dimensional microfabrication process using Bi electrodeposition for a highly sensitive X-ray imaging sensor", *J. Electroanal. Chem.*, **584**, 28-33 (2005).
- 7) H. Sato, T. Homma, K. Mori, T. Osaka, S. Shoji, "Electrochemical formation process of Si macropore and metal filling for high aspect ratio metal microstructure using single electrolyte system", *Electrochemistry*, **73**, 275-278 (2005).

- 8)** T. Homma, H. Sato, K. Mori, T. Osaka, S. Shoji, “Area-selective formation of macropore array by anisotropic electrochemical etching on an n-Si(100) surface in aqueous HF solution”, *J. Phys. Chem. B*, **109**, 5724-5727 (2005).
- 9)** N. Honda, M. Inaba, T. Katagiri, S. Shoji, H. Sato, T. Homma, T. Osaka, M. Saito, J. Mizuno, Y. Wada, “High efficiency electrochemical immuno sensors using 3D comb electrodes”, *Biosens. Bioelectron.*, **20**, 2306-2309 (2005).
- 10)** H. Sato, H. Kobayashi, H. Kudo, T. Izumi, T. Homma, T. Osaka, S. Shoji, Y. Ishisaki, R. Fujimoto, K. Mitsuda, “Development of Bi electrodeposition process for fabricating microabsorber array for high sensitive X-ray imaging sensor”, *Electrochemistry*, **72**, 424-426 (2004).
- 11)** T. Homma, H. Sato, K. Mori, T. Osaka, S. Shoji, “High aspect ratio nanovolume glass cell array fabricated by area-selective silicon electrochemical etching process”, *Proc. IEEE MEMS*, 705-708 (2004).
- 12)** T. Arakawa, H. Kudo, H. Sato, H. Kobayashi, T. Izumi, S. Ohtsuka, K. Mori, S. Shoji, T. Osaka, T. Homma, K. Mitsuda, N. Yamasaki, R. Fujimoto, N. Iyomoto, Y. Ishisaki, U. Morita, T. Koga, K. Shinozaki, K. Sato, N. Takai, T. Ohashi, Y. Kuroda, M. Onishi, M. Goto, F. Beppu, “Fabrication of multi-pixel TES microcalorimeters with an electrodeposited Sn absorber and Bi absorber”, *Nucl. Instrum. Methods Phys. Res., Sect. A*, **520**, 456-459 (2004).
- 13)** H. Kudo, T. Nakamura, T. Arakawa, S. Ohtsuka, T. Izumi, S. Shoji, H. Sato, H. Kobayashi, K. Mori, T. Homma, T. Osaka, K. Mitsuda, N. Y. Yamasaki, R. Fujimoto, N. Iyomoto, T. Oshima, K. Futamoto, Y. Takei, T. Ichitsubo, T. Fujimori, Y. Ishisaki, U. Morita, T. Koga, K. Sato, T. Ohashi, Y. Kuroda, M. Onishi, K. Otake, F. Beppu, “Prototype of the high sensitive X-ray microcalorimeter for X-ray imaging”, *Sens. Actuators, A*, **114**, 171-175 (2004)
- 14)** H. Kudo, T. Arakawa, S. Ohtsuka, T. Izumi, S. Shoji, H. Sato, H. Kobayashi, K. Mori, T. Homma, T. Osaka, N. Iyomoto, R. Fujimoto, K. Mitsuda, N. Y. Yamasaki, T. Oshima, K. Futamoto, Y. Takei, T. Ichitsubo, T. Fujimori, Y. Ishisaki, U. Morita, T. Koga, K. Shinozaki, K. Sato, T. Ohashi, Y. Kuroda, M. Onishi, K. Otake, F. Beppu, “High sensitive X-ray microcalorimeter using Bi-Au microabsorber for imaging applications”, *Jpn. J. Appl. Phys., Part 1*, **43**, 1190-1195 (2004).
- 15)** R. Fujimoto, K. Mitsuda, N. Y. Yamasaki, N. Iyomoto, T. Oshima, Y. Takei, K. Futamoto, T. Ichitsubo, T. Fujimori, K. Yoshida, Y. Ishisaki, U. Morita, T. Koga, K. Shinozaki, K. Sato, N. Takai, T. Ohashi, H. Kudo, H. Sato, T. Arakawa, H. Kobayashi, T. Izumi, S. Ohtsuka, K. Mori, S. Shoji, T. Osaka, T. Homma, Y. Kuroda, M. Onishi, M. Goto, F. Beppu, T. Tanaka, T. Morooka, S. Nakayama, K. Chinone, “TES microcalorimeter development for future Japanese X-ray astronomy missions”, *Nucl. Instrum. Methods Phys. Res., Sect. A*, **520**, 431-434 (2004).
- 16)** Y. Ishisaki, U. Morita, T. Koga, K. Shinozaki, K. Sato, N. Takai, T. Ohashi, T. Arakawa, H. Kudo, H. Sato, H. Kobayashi, T. Izumi, S. Ohtsuka, K. Mori, S. Shoji, T. Osaka, T. Homma, K. Mitsuda, N. Y. Yamasaki, R. Fujimoto, N. Iyomoto, T. Oshima, K. Futamoto, Y. Takei, T. Ichitsubo, T. Fujimori, K. Yoshida, Y. Kuroda, M. Onishi, M. Goto, F. Beppu, “Performance analyse's of TES microcalorimeters with mushroom shaped X-ray absorbers made of Sn or Bi”, *Nucl. Instrum. Methods Phys. Res., Sect. A*, **520**, 452-455 (2004).
- 17)** T. Homma, H. Sato, H. Kobayashi, T. Arakawa, H. Kudo, T. Osaka, S. Shoji, Y. Ishisaki, T. Oshima,

N. Iyomoto, R. Fujimoto, K. Mitsuda, "Sn electrodeposition process for fabricating microabsorber arrays for an X-ray microcalorimeter", *J. Electroanal. Chem.*, **559**, 143-148 (2003).

Awards

- 1) UK-Japan Research Exchange Scholarship
Nanotechnology Research Network Center, MEXT Japan, 2006.
- 2) Poster Session Award, 1st prize
International Symposium on Electrochemical Processing of Tailored Materials, Oct., 2005.
- 3) Mizuno Memorial Award for Outstanding Doctoral Thesis
Waseda University, 2005.
- 4) Best Presentation Award
International Symposium on Electrochemical Micro and Nanosystem Technologies, Sep., 2004.
- 5) Poster Session Award, 2nd prize
International Symposium on Materials Processing for Nanostructured Device, Sep., 2001.

Patents

- 1) T. Homma, S. Shoji, T. Osaka, H. Sato, "Microreactor and its fabrication process", Japanese Patent 2005-207901, Aug. 4, 2005.
- 2) N. Honda, S. Shoji, T. Homma, H. Sato, "Fabrication of micro-electrode and measurement of electrolyte with it", Japanese Patent 2004-93406, March 25, 2004.

Book Chapter

H. Sato, T. Homma, "Simultaneous formation of nanostructures", *Comprehensive Dictionary of Nanotechnology*, 400-409 (2003).

Presentations at International Conferences

- 1) "Development of electrochemical etching process for size-controllable pore-formation into Si wafer" , UK-Japan Collaboration Day, Sep., 2006. **【Invited Lecture】**
- 2) "Size-controllable formation of pore array into Si wafer using electrochemical etching", The 57th International Society of Electrochemistry, Aug., 2006.
- 3) "Formation process of micro-glass-tube array for fluid device based upon Si electrochemical etching and thermal oxidation", The 4th International Symposium on Electrochemical Processing of Tailored Materials, Oct., 2005.
- 4) "Three-dimensional electrodeposition process for fabrication of arrayed high sensitive X-ray microsensors", The 56th International Society of Electrochemistry, Sep., 2005.
- 5) "Formation of 256 pixels of X-ray microcalorimeters applying three-dimensional electrodeposition process for arrayed X-ray absorbers", The 11th International Workshop on Low Temperature Detectors, Aug., 2005.

- 6) “Electroless deposition process for synthesis of composite metal nanoparticles using micro-fluidic device”, The 5th Asian Conference on Electrochemistry, May, 2005.
- 7) “Development of a microreactor with nanovolume glass tube array fabricated by area-selective Si electrochemical etching process”, The 5th International Symposium on Electrochemical Micro and Nanosystem Technologies, Sep., 2004.
- 8) “Fabrication of the array of high sensitive X-ray microdetectors by electrochemical micromachining process”, International Symposium on Materials Processing for Nanostructured Devices, May, 2003.
- 9) “Modification of Si anodization process for area selective formation of high aspect ratio micropore array”, The 53rd International Society of Electrochemistry, Sep., 2002.
- 10) “Application of Sn electrodeposition process to fabricate X-ray microcalorimeter”, International Symposium on Materials Processing for Nanostructured Devices, Sep., 2001.
- 11) “Fabrication of microabsorber array for X-ray microcalorimeter by Sn electrodeposition”, The 200th The Electrochemical Society, Sep., 2001.

Experimental Skills

Preparation of nano/micro structured specimens (Wafer processing)

- **Electrodeposition** of various metals and alloys (Au, Ag, Co, Cu, Fe, Ni, Pd and etc)
- Electroless-deposition of various metals and alloys (Au, Co, Cu, Ni, Pd and etc)
- Electrochemical etching, electrochemical polishing and chemical etching of Si and various metals
- Photolithography system to form photoresist masks and molds
- RIE and D-RIE for deep etching of Si wafers
- Sputtering, evaporation and CVD to prepare thin films
- CMP (Chemical Mechanical Polishing) to flatten surfaces

Manipulation and operation of specimens and micro-devices

- Micro sample-manipulator to inject liquid specimens into micro-channels and micro-tubes
- Flow control systems equipped with optical microscopes, CCD cameras and syringe pumps for micro-fluidic devices
- Potentiostat/Galvanostat systems and function generators to operate electrochemical detection devices

Observation of specimens

- TEM and SEM to observe nano/micro-structures
- FIB to prepare cross-sections of specimens for SEM and TEM observation
- AFM and MFM to measure surface morphologies and magnetic states

Evaluation and analysis of specimens

- VSM (Vibration Sample Magnetometer) to measure magnetic properties
- XRD to analyze crystal structures
- UV-Vis, IR, and Raman spectrometers to analyze molecular states in aqueous solutions

- EPMA (Electron Probe Micro-Analysis) for elemental analysis

Simulation tool

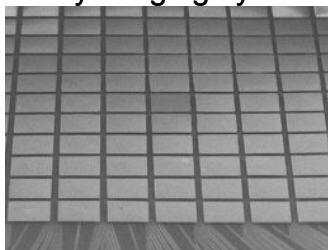
- Coventor ware

Current Interests and Research Activities

Electrodeposition, Electroless Deposition, Electrochemical Etching, Electrochemical Polishing, and Nanoparticles, MEMS, Nano/Micro-Fabrication Processes.

Studied MEMS processes, by using electrochemical methods, for fabricating multi-pixels of X-ray micro-sensors, magnetic thin films, metal nanoparticles, high aspect ratio structures, and 3-D micro-electrode arrays. Developed processes for **electrodeposition** and electrochemical polishing of Sn and Bi to form X-ray micro-sensors applied to the **X-ray imaging system** to be loaded on the next projected space satellite. Investigated effects of electroless deposition conditions on magnetic properties of CoNiP thin films, resulting in successful control of coercivity H_c and saturated magnetization M_s of the CoNiP thin film by adjusting the diffusion rates of the metal ions. Synthesized composite metal nanoparticles by means of electroless deposition with **micro-fluidic devices**. Developed an **electrochemical etching** process of Si wafer to form high-aspect-ratio pore arrays, and applied them as the template for **micro-glass-tube arrays** and metal micro-needle arrays. Fabricated **3-D micro-electrode arrays** for immunosensors by Ni and Cu electrodeposition and Au electroless deposition, and improved their fabrication conditions to obtain appropriate properties and smooth surfaces of the electrodeposited specimens.

Electrodeposition
X-ray imaging system

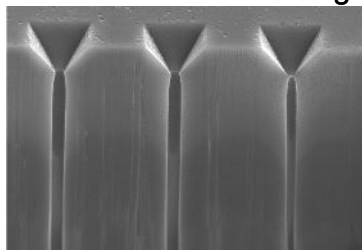


500 μm

Electroless deposition
Micro-fluidic devices

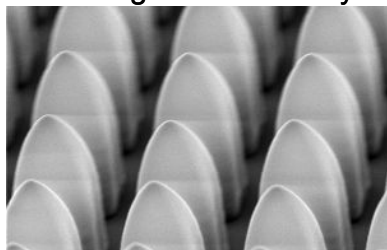


Electrochemical etching



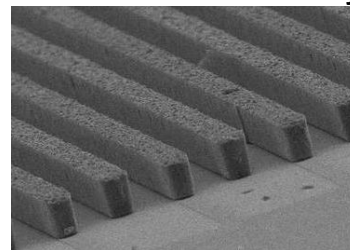
5 μm

Micro-glass-tube array



5 μm

Electrodeposition
3-D micro-electrode array



10 μm